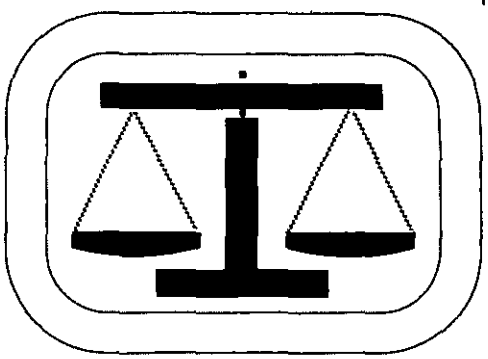
ENGINEERING REPORT

for

CONTRACT NUMBER DACW-33-81-D-0005
WORK ORDER NUMBER 0003

SUBSURFACE INVESTIGATION

FLOOD CONTROL AND PIPELINE PROJECT
HARTLAND, MAINE



BRIGGS

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1.0 GENERAL

1.1 Authorization

The subsurface exploration work for proposed flood control and pipeleine project in Hartland, Maine, reported herein was performed under Contract DACW-33-81-D-0005, Work Order No. 0003, dated 20 April 1982. The authority for this project is derived from Section 205 of the 1948 Flood Control Act as amended. The contracting officer is Arthur N. Rappaport, Lt. Col.

1.2 Project Site

The site is located in the vicinity of the Sebasticook River in Hartland, Maine.

1.3 Purpose of the Investigation

The subsurface information obtained from the exploration program is required to determine the depth to bedrock and the characteristics of the soil and bedrock in order to design the foundation and plan the construction of the proposed flood control wall, earth dike and 18 inch pipeline, including the intake structure.

1.4 Scope of the Investigation

The work performed under this work order consisted of the following:

a. Performing a seismic survey along the proposed pipeleine route in order to determine the depth of bedrock. This work was performed by Weston Geophysical, Inc. on 12 and 13 May 1982. Weston's report is attached as Appendix C.

b. Drilling 6 test borings and performing 8 hand probes and 13 soundings at the locations shown on the Exploration Location Plans. Borings A, B and C were advanced 15 feet into rock and Borings E and G were advanced 10 feet into rock. No rock was encountered in Boring D. The borings were drilled between 10 May and 15 May 1982 by Briggs Engineering and Testing Company, Inc. of Norwell, Massachusetts. Field exploration logs are included in Appendix A. The hand probes were performed on 11 and 14 May 1982.

c. Surveying the location of the seismic lines and the ground surface elevation of the borings, soundings and hand probes. This work was performed by Briggs Engineering and Testing Company, Inc. on 14 and 15 May 1982.

2.0 SUBSURFACE CONDITIONS

2.1 Subsurface Materials

The following subsurface materials were encountered when the borings where drilled at the site.

a. Miscellaneous Fill consisting primarily of gravelly sand was encountered in Borings A through E, but not in Boring G. The fill was encountered at the ground surface and extended to a maximum depth of 7 feet below the existing grade.

b. Glacial Till was encountered in Borings C, D and E only. The till which underlies the miscellaneous fill and overlies the bedrock is a very dense, gray, silty sand with cobbles and boulders. The till ranges in thickness from 2.75 to at least 25 feet.

c. Phyllite The phyllite has closely spaced, poorly to well developed vertical cleavage and widely spaced high angle joints. It is fine-grained, hard, slightly to moderately weathered and dark gray in color. In Borings A and B, the first few feet of the phyllite are severely weathered and very soft. Core recoveries were generally over 80 percent.

d. Metasandstone was encountered in Boring C only. The metasandstone had very poorly developed vertical cleavage, widely spaced joints with an apparent dip between 30 and 45 degrees, was very hard and fine-grained. Core recovery was over 75 percent.

2.2 Groundwater

Groundwater was encountered in all borings. When possible, the water level in each boring was measured in the morning prior to commencing any drilling operations. The water levels are summarized on the Subsurface Exploration Logs.

3.0 QUALITY CONTROL

3.1 Test Borings

3.1.1 Equipment

The equipment and type of tools used are described below.

a. Core Drill: The core drill used was a modern hydraulically driven rotory head unit manufactured by Sprague and Henwood.

b. Drive Hammer: The drive hammer used to advance both the casing and solid barrel samplers weighed approximately 300 pounds.

c. Casing and Rods: HW (4 in.) and NW (3 in.) flush joint casing was used to keep the borehole in overburden open. AW drill rods were used in washing out the casing.

d. Samplers: The equipment used to obtain soil samples was the solid barrel sampler type with a ball check head in sizes 2 1/2 and 2 inch ID by 5 ft., with spring type retainers. The equipment used to obtain rock samples was the swivel head double tube NX core barrel by 5 ft., with a surface mounted diamond bit.

3.1.2 Records

NED Forms 58 and 58A, dated March 1971 and entitled "Field Log of Test Boring" and NED Form 130, dated December 1960 and entitled "Field Log of Test Boring in Rock" were used to record pertinent drilling and sampling data. The logs include the following:

a. Site location, boring location and number.

b. Make and model of drilling equipment.

c. Type of drilling and sampling operation by depth.

d. Depths at which soil samples or rock cores were recovered, including top and bottom depth of each run. Classification or description of the soil and rock samples obtained. Indication of penetration resistance such as drive hammer blows given in blows per penetration depth for driving sample spoons.

e. Length of sample of soil or rock recovered per sampling run.

f. Depth at which groundwater is encountered.

3.1.3 Procedures

a. Boreholes were advanced by continuous sampling in which either a 2 1/2 or a 2 inch ID x five foot solid spoon sampler was advanced below the bottom casing into undisturbed soil by the impact of a hammer weighing approximately 300 pounds falling 18 inches. Refusal was defined as 100 blows for no penetration or bouncing refusal.

b. The sample spoon shoes were kept reasonably sharp at all times. Dull, bent, or otherwise damaged samplers were not used. Sampling was accomplished to a depth of not more than five feet below the bottom of the casing, after which the casing was advanced to the previously sampled depth and cleaned out using appropriately sized roller bits and side discharging chopping bits.

c. Upon reaching the top of rock, the borehole was advanced by coring with a swivel head double tube NWX core barrel. Sampling runs did not exceed five feet.

d. Samples were classified in the field immediately following the taking of the sample. Classification was in accordance with ASTM D-2487 and D-2488. Representative samples were take from each soil sampling run and placed in 16 oz. glass jars with hermetically sealed lids. Jars were labeled with sample number, sampling interval, boring number, date, location, penetration resistance and soil description. Rock cores obtained from each coring run were placed in 5 foot wooden core boxes which were labeled with the job location, boring number and depth interval covered by the run. A chain of custody log was maintained documenting custody of the samples between the field and transportation and delivery to the laboratory.

3.2 Hand Probes/Soundings

3.2.1 Equipment

The equipment used to conduct the hand probes was 1 inch outside diameter steel rods with flush joint connections and an 8 pound sledge hammer. The soundings were performed off a 16 foot fiberglass boat with motor using a 100 foot fiberglass tape with a 2 pound weight attached.

3.2.2 Records

Pertinent data for the hand probes and soundings are recorded on the Exploration Location Plan. The data includes date and location of the exploration, method of penetration, depth of penetration, type of material encountered as determined by sound and the performance of the probing operation, ground surface elevation and depth to water.

3.2.3 Procedure

The hand probes were performed along line HP-1 only. The probes were conducted by advancing the metal pipe into the soil

using the weight of one man until penetration stopped. Then the pipe was advanced by the impact of an eight pound sledge hammar to refusal. Refusal is defined by the resistance to 6 inches or less of penetration by 10 blows of the 8 pound sledge.

Soundings were performed along HP-2 and HP-3 by establishing range lines on shore and using these range lines to determine the location of each sounding. It was not possible to take probings along these lines. The river current made it very difficult to stabilize the boat long enough in one position to take a probe. In addition, it would not be possible to pull the rods out of the soil without capsizing the boat.

3.3 Survey

3.3.1 Equipment

The surveying equipment used to locate the seismic lines and establish the elevation of the test borings were a 100 foot steel tape, a lo foot stadia rod and a levelling gun.

3.3.2 Procedures

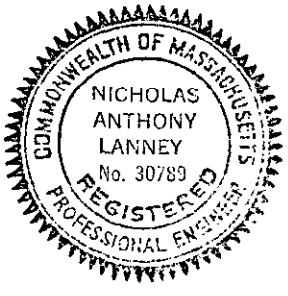
The elevation of each boring was established by differential levelling using the top of the concrete wall located at the north end of the Great Moose Lake dam as the datum. The elevation of the top of this wall is given as 249.4 feet NGVD. The chisel square located at the corner of Main and Commercial could not be found. The seismic line was located by taping the distance form various marked points along the seismic line to exisitng physical features.

3.3.3 Results

The results of the field survey are provided in the field survey notes which are included as Appendix B to this report.

4.0 QUALITY CONTROL CERTIFICATION

I hereby certify that the above mentioned records, equipment and procedures were used to perform the subsurface exploration described herein. I also certify that the work was performed in a professional manner and meets the requirements set forth in the work order.



CERTIFIED 05 JULY 1982

Nicholas A. Lanney, P.E.
Masschusetts No. 30789

BRIGGS ENGINEERING CORPORATION

Chain of Custody Log

Project: Subsurface Investigation: Proposed Pipeline and Flood Control Project
Hartland, Maine

Items:

Tubes	None
Bottles	None
Jar Samples	26
Core Boxes	5
Sampling Logs	Borings FD 82-1, FD 82-2, FD-82-3, FD-82-4, FD-82-5, FD-82-6

Date & Time Received	Date & Time Transfered	Comments	Custodian
as sampled	5/17/82 0800		
5/17/82 0800	5/18/82		
5/18/82 1050			

BRIGGS ENGINEERING CORPORATION

WEEKLY SAFETY MEETING

TO: Safety Office, NED

FROM: Field Engineer — Date held 10 MAY 1982

THRU: Project Engineer — Time 1400

Weekly safety meeting was held this date for the following personnel:
Contract No. DACW 33-81-D-0005 Personnel present: R. Jones
Work Order No. 0003 W. Souza
Conducted By: N.A. Lanney J. Crowther

1. Subjects discussed (Note, delete, or add):

x Individual Protective Equipment -
Prevention of Falls -
x Safe Lifting Techniques -
Emergency Communications -
Fire Prevention -
Sanitation, First Aid -
x Tripping Hazards - trash, hose, nails in lumber -
Staging, Ladders, Concrete Forms -
Hand Tools -
Portable Power Tools -
Woodworking Machinery -
Equipment Maintenance (Zero defects) -
Hoisting Equipment -
Ropes, Hooks, Chains and Slings -
Electrical Grounding, Temporary Wiring -
Lockouts for safe clearance procedures -
Electrical, pressure, moving parts -
Welding -
Excavations -
Loose Rock and Steep Slopes -
Explosives -
x Water Safety -
Other -

Prepared by: Nicholas Lanney
Field Engineer

2. Exposure:

Start of new work order. No previous exposure.

Signature: Nicholas Lanney
Project Engineer

3. Forwarded: NED, Waltham, MA

BRIGGS ENGINEERING CORPORATION

WEEKLY SAFETY MEETING

TO: Safety Office, NED

FROM: Field Engineer Date held No meeting held

THRU: Project Engineer Time_____

Weekly safety meeting was held this date for the following personnel:
Contract No. DACW 33-81-D-0005 Personnel present:_____
Work Order No. 0003 _____
Conducted By:_____ _____

1. Subjects discussed (Note, delete, or add):

Individual Protective Equipment -
Prevention of Falls -
Safe Lifting Techniques -
Emergency Communications -
Fire Prevention -
Sanitation, First Aid -
Tripping Hazards - trash, hose, nails in lumber -
Staging, Ladders, Concrete Forms -
Hand Tools -
Portable Power Tools -
Woodworking Machinery -
Equipment Maintenance (Zero defects) -
Hoisting Equipment -
Ropes, Hooks, Chains and Slings -
Electrical Grounding, Temporary Wiring -
Lockouts for safe clearance procedures -
Electrical, pressure, moving parts -
Welding -
Excavations -
Loose Rock and Steep Slopes -
Explosives -
Water Safety -
Other -

Prepared by: Nicholas Lowrey
Field Engineer

2. Exposure:

For the period 10 through 15 May 1982, covering 210 man hours.

Signature: Nicholas Lowrey
Project Engineer

3. Forwarded: NED, Waltham, MA

GREAT MOOSE LAKE

N

HP-2 I H G F E D

HP-3 N M L K J

"G"

CROSS LINE 13+30

CROSS LINE 11+50

STA 10+50

MILL STREET

SEBASTICOOK CHANNEL

"B"

"A"

MAIN STREET

RIVER

IRVING TANNERY

STA 0+0

"C"

STA 1+0

STA 2+0

STA 3+0

STA 4+0

SEISMIC LINE S-2

COMMERCIAL ST.

STA 7+50

SEISMIC LINE S-1

"E"

WATER STREET

STA 2+50

"D"

NORTH ST.

W.H. MOORE

SEE SHEET 2 FOR HAND PROBE DETAILS

SOUNDING LOCATIONS	WATER DEPTH
D	5'
E	7'
F	9'
G	9'
H	8.5'
I	8'
J	4'
K	6'
L	13'
M	7.5'
N	7'

BEDROCK OUTCROPS

SEISMIC LINE WITH STATIONS

"D" BORING LOCATION & DESIGNATION

NOTES:

1.) Soundings on Great Moose Lake taken on May 12, 1982. Water level at elevation 244.65 on May 14, 1982.

2.) Soundings indicate a rocky lake bottom.

BRIGGS ENGINEERING & TESTING CO.
164 WASHINGTON ST. NORWELL, MA.

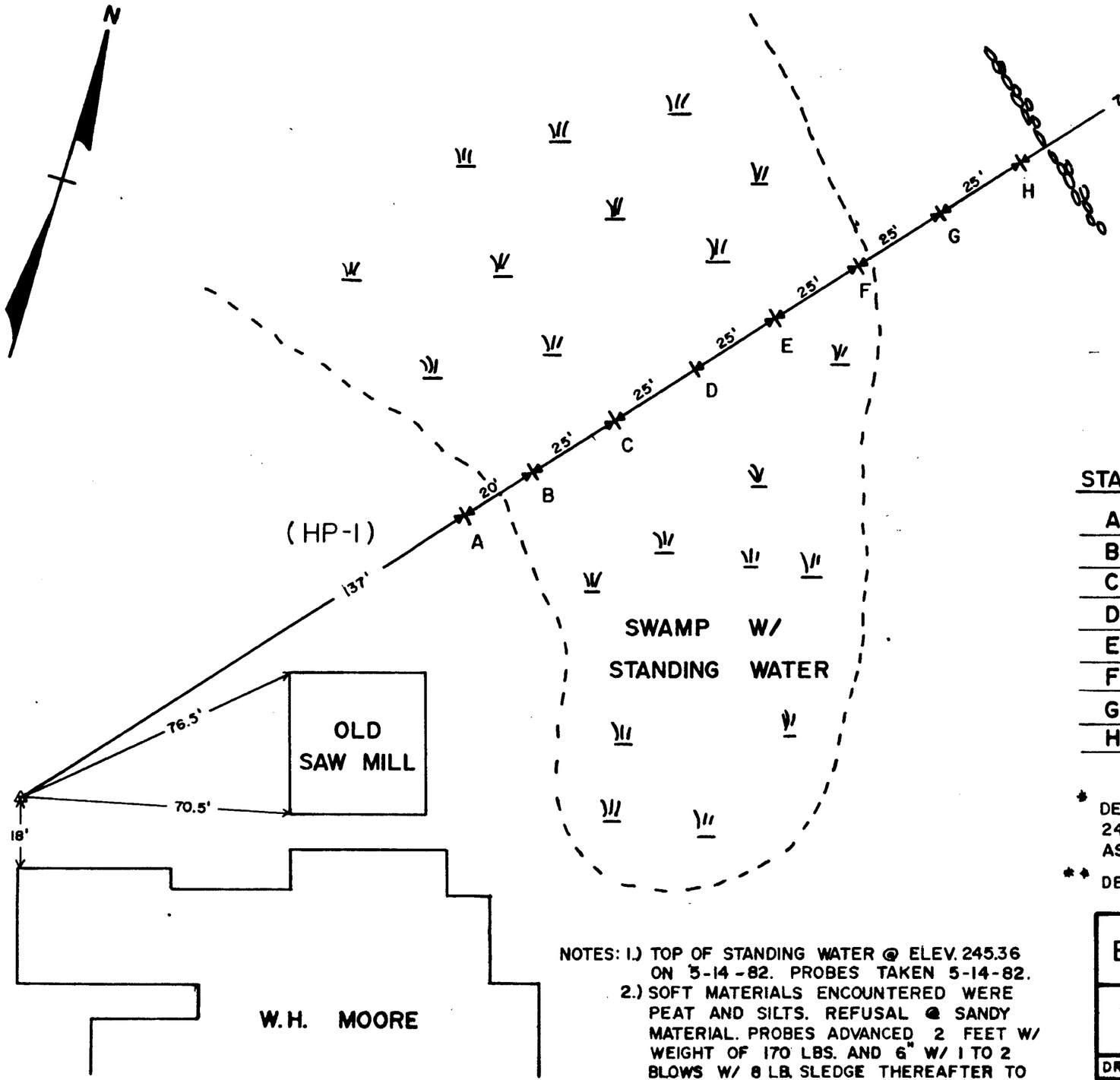
PROJ. NO. 13101

TITLE: EXPLORATION LOCATION PLAN

SCALE: 1" = 100' | DATE: 5-21-82

DRAWN: J.C.C. | CHECKED: N.A.L.

SHEET 1 of 2



STATION	WATER DEPTH	DEPTH TO REFUSAL
A	0"	70" * *
B	12"	80" *
C	12"	56" *
D	8"	47" *
E	2"	24" *
F	3"	24" *
G	0"	20" * *
H	0"	22" * *

* DEPTH TO REFUSAL MEASURED FROM ELEV. 245.36, THE LEVEL OF WATER IN THE SWAMP AS RECORDED ON 5-14-82.

** DEPTH TO REFUSAL MEASURED FROM ELEV. 245.7 ±

NOTES: 1.) TOP OF STANDING WATER @ ELEV. 245.36 ON 5-14-82. PROBES TAKEN 5-14-82.
2.) SOFT MATERIALS ENCOUNTERED WERE PEAT AND SILTS. REFUSAL @ SANDY MATERIAL. PROBES ADVANCED 2 FEET W/ WEIGHT OF 170 LBS. AND 6" W/ 1 TO 2 BLOWS W/ 8 LB. SLEDGE THEREAFTER TO REFUSAL AT + 10 BLOWS.

EXPLORATION LOCATION PLAN

BRIGGS ENGINEERING & TESTING CO.
NORWELL, MASS.

DR. BY: J.C.C.	SCALE: 1" = 30'	PROJ. NO.: 13101
CK'D BY: N.A.L	DATE: 5-19-82	SHEET 2 OF 2

APPENDIX A

Field Exploration Logs

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site HARTLAND, ME Page 1 of 4 Pages

Boring No. FD-82-1 Desig. A Diam. (Casing) 4

Co-ordinates: N _____ E _____

Elevation Top of Boring 228.98 M.S.L. Hammer Wt. 300 Boring Started 5/10/82

Total Overburden Drilled 8.0 Feet Hammer Drop 18 Boring Completed 5/11/82

Elevation Top of Rock 220.98 M.S.L. Casing Left 0

Total Rock Drilled 15.0 Feet Subsurface Water Data _____ Page 3

Elevation Bottom of Boring 205.98 M.S.L. Obs. Well _____

Total Depth of Boring 23 Feet Drilled By Briggs Engineering

Core Recovered 91 % No. Boxes 2 Mfg. Des. Drill Sprague & Henwood

Core Recovered 13.6' Ft: NX Diam. 2 1/8 in. Inspected By: N. Lanney

Soil Samples 2 1/2 In. Diam. 3 No. Classification By: _____

Soil Samples _____ In. Diam. ____ No. Classification By: _____

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
5/10/82 AAS						
2	J1 1 jar	2 1/2"	0 to 5	26 55 40 35 32	Drove 2 1/2" ID x 5' solid spoon sampler from 0' to 5' and took sample. Recovered 6" Drove 4" casing to 5.0 and washed out casing using 3" roller bit	FILL: Gravelly Sand, coarse to fine sand, 25-35% coarse to fine gravel, 5-8% non-plastic fines, brown, damp (SP)
4						
1530 HRS						
6	J2 2 jars	2 1/2"	5' to 7.5'	17 18	Drove 2 1/2" ID by 5' solid barrel sampler from 5' to 7.5' and took sample. Recovered 12"	
7.0				129/6"	Drove casing to 7.5' and roller rocked down to 8.0'	Top of Rock at 7.0' Weathered Rock
8.0	RUN I	NX	8 to 12	31"	Cored from 8 to 12' with NX double core barrel and recovered 31". Lost water at 11.5'. Appeared	PHYLLITE highly fractured, vertical cleavage, moderately weathered, dk gray to black.
10						

GENERAL REMARKS: that end of barrel was plugged & prevented water from exiting from barrel.

Site: HARTLAND, ME

Boring No. FD-82-1

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATER ALS
5/11/82 0700 12						
14	RUN II	NX	12 to 15.5	100%	Cored from 12 to 15.5' with NX double tube barrel and recovered 42". No return water due to highly fractured rock	PHYLLITE, vertical cleavage & fractures along cleavage planes, slightly weathered, medium hard, dk gray to black. Calcite veins scattered throughout Iron staining along some fractures.
16	RUN III	NX	15.5 to 20.25	100%	Cored from 15.5 to 20.25 with NX double tube barrel and recovered 60" Water returned at 19.5'	
18						
20 1015	RUN IV	NX	20.25 to 23	91%	Cored ~~from~~ 20.25 to 23.0' with NX double tube barrel and recovered 30"	
23.0 1130					END OF BORING AT	23'

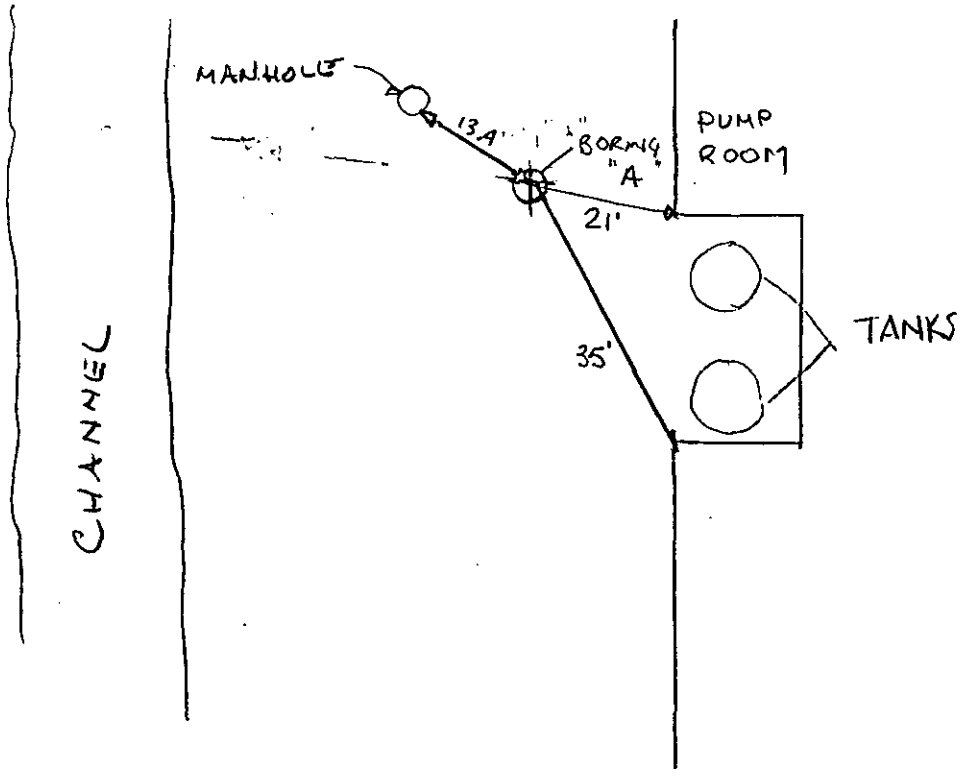
Site: HARTLAND, MG
Boring No: FD-82-1

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
5-11-81	0700	7'	12' *	11.33'		

Note: Depths are in feet below original ground
* at time of water reading

BORING LOCATION SKETCH



FIELD LOG OF TEST BORING IN ROCK

SITE HARTLAND ME HOLE NO. FD-82-1 PAGE 4/4

DATE	DEPTH FT. FROM	DEPTH FT. TO	RUN FT.	RUN REC'V'Y FT.	REC'V'Y %	DRILLING BEHAVIOR: FEED	DRILLING BEHAVIOR: WATER	DRILLING BEHAVIOR: REASON FOR PULL	ACTUAL DRILLING TIME	BIT NO. SIZE AND TYPE	ADDITIONAL REMARKS
5-10-82	8	12	48"	31"	65	—	lost water at 11.5'. Plugged barrel	barrel jammed	30 min	NX	Cores jams in barrel, preventing us from taking 5' core runs
5-11-82	12	15.5	42"	42"	100	—	no return water	barrel jammed	43min	NX	
	15.5	20.25	57"	60"	100	—	water returned at 19.5'	barrel full	63.5	NX	
	20.25	23	33"	30	91	—	lost water at 20.25	End of hole	44.5	NX	

TOTAL BED ROCK DRILLED 15 FEET

TOTAL BED ROCK RECOVERED 13.6' FEET

BED ROCK RECOVERY 91 PERCENT

DRILLER R. JONES

INSPECTOR N. LANNEY

NED FORM DEC 63 130

REPLACES EDITION OF APR 49 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site Hartland Mc. Page 1 of 4 Pages

Boring No. FD-82-2 Desig. B Diam. (Casing) 4"/3"

Co-ordinates: N _____ E _____

Elevation Top of Boring 222.68 M.S.L. Hammer Wt. 300 lb. Boring Started 5-11-82

Total Overburden Drilled 7.5 Feet Hammer Drop 18" Boring Completed 5-12-82

Elevation Top of Rock 215.18 M.S.L. Casing Left 0

Total Rock Drilled 15 Feet Subsurface Water Data _____ Page 3

Elevation Bottom of Boring 200.18 M.S.L. Obs. Well _____

Total Depth of Boring 22.5 Feet Drilled By Briggs Engineering

Core Recovered 92 % No. Boxes 1 Mfg. Des. Drill Sprague + Henwood

Core Recovered 13.75 Ft: NX Diam. 2 1/8 In. Inspected By: J. Crowther

Soil Samples 2 1/2 In. Diam. 2 No. Classification By: _____

Soil Samples 2 In. Diam. 1 No. Classification By: _____

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
5/11/82 1330	J1 1 & 1	2 1/2" S	0. to 2.5	20 / 15	Drove 2 1/2" I.D. x 5' solid spoon sampler from 0.0' to 3.0' - sampled - recovered 1'	Fill: Gravelly Sand - coarse to fine sand, 25-30% coarse to fine gravel 5-15% non plastic fines, numerous boulders & cobbles, some brick & wood, brown - dark brown (SP) damp
2.5				11		
	J2 1 & 1	2 1/2"	2.5 to 3.0		Hit boulder @ 2.5' - moved rig tried to advance 4" casing 3 times - boulders - no success - drilled ahead using 3" casing w/ diamond casing bit	Cobbles + Boulders - probable old river bed
5.5						
1450	J3 1 & 1	2"S	5.5 to 7.5	32 / 82 / 55/1"	Drove 2" x 5' solid barrel sampler from 5.5 to 7.5' and hit refusal at 7.5'. Rec. 12". Drilled 3" casing to 7.5	Phyllite highly weathered very soft, closely spaced, vertical cleavage, dk gray to black
1530	Run I	NX	7.5 to 10.75	24"	Cored from 7.5 to 10.75 with NX double tube barrel and recovered 24"	Top of Sound Rock
9.0						Phyllite, closely spaced steply inclined vertical cleavage, medium hard slightly weathered, dk gray, some calcite veins
1630			10.75			

GENERAL REMARKS:

NAD FORM 7.58 (Test)

Boring No. FD-82-2

Site: Hartland Me.

Boring No. FD-82-2

Page 2 of 4

DEPTH	CORE/SAMPLE NO.	CORE/SAMPLE SIZE	CORE/SAMPLE DEPTH RANGE	BLOWS PER FT. CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
5/12/87 0700						Phyllite continued
12	II	NX	10.5 to 15.5	100%	Cored from 10.75 to 15.5' with NX double tube barrel and took sample. Rec. 57" No water loss.	
14						
16	III	NX	15.5 to 18.5	100	Cored from 15.5 to 18.5 with NX double tube barrel and recovered 36" Lost water at 15.6'	
18						
20	IV	NX	18.5 to 22.5	100	Cored from 18.5 to 22.5 with NX double tubebarrel and recovered 48"	
5/12/82 1000 22						
22.5					Bottom of hole @ 22.5'	

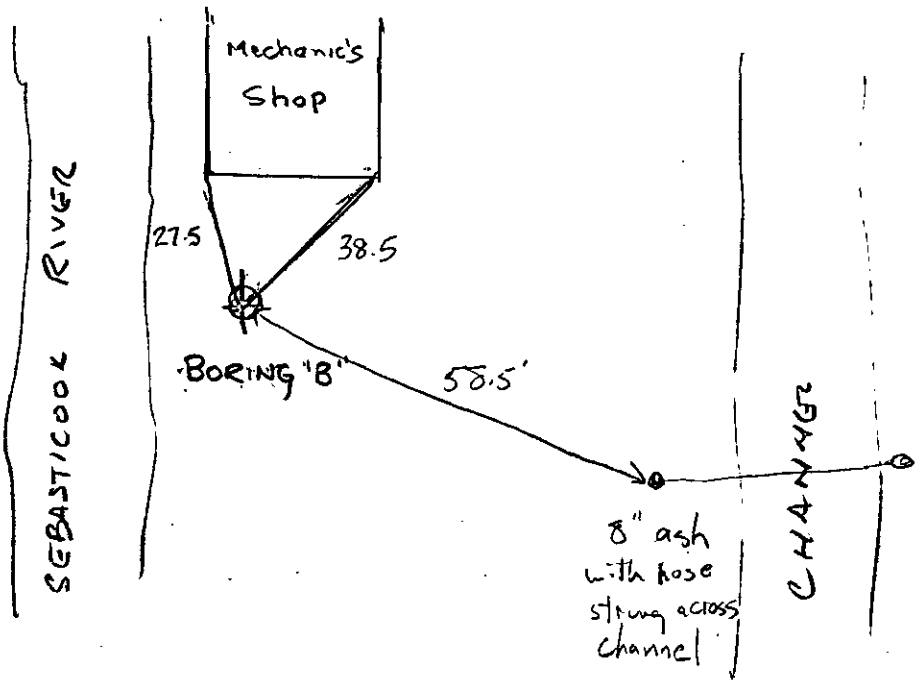
Site: Hartland Me
Boring No: FD-82-2

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
5-12-82	0700	7.5'	10.75' *	5.5'		

Note: Depths are in feet below original ground
* At time of water reading

BORING LOCATION SKETCH



FIELD LOG OF TEST BORING IN ROCK

SITE Hartland Me. HOLE NO. FD-82-2 PAGE 4 of 4

DATE	DEPTH PT. FROM	DEPTH PT. TO	RUN PT.	RUN REC'V'Y PT.	REC'V'Y %	DRILLING BEHAVIOR: FEED	DRILLING BEHAVIOR: WATER	DRILLING BEHAVIOR: REASON FOR PULL	ACTUAL DRILLING TIME	BIT NO. SIZE AND TYPE	ADDITIONAL REMARKS
5-11-82	7.5	10.75	39"	24"	61.5	—	no water loss	core jammed in barrel	36.5	NX	
5-12-82	10.75	15.5	57"	57"	100		no H_2O loss	" "	34.5	NX	
	15.5	18.5	36"	36"	100		lost water at 15.6'	core jammed in barrel	30.5	NX	
	18.5	22.5	48"	48"	100			end of boring	33	NX	

TOTAL BED ROCK DRILLED 15' FEET

TOTAL BED ROCK RECOVERED 13.75' FEET

BED ROCK RECOVERY 92 PERCENT

DRILLER R. Jones

INSPECTOR J. Crowther

NED FORM DEC 63 130

REPLACES EDITION OF APR 49 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site Hartland Mc Page 1 of 3 Pages

Boring No. FD-82-3 Desig. D Diam. (Casing) 4"/3"

Co-ordinates: N _____ E _____

Elevation Top of Boring 241.06 M.S.L. Hammer Wt. 300 lb. Boring Started 5-12-82

Total Overburden Drilled 25 ① Feet Hammer Drop 18" Boring Completed 5-13-82

Elevation Top of Rock none found M.S.L. Casing Left 0

Total Rock Drilled 0 Feet Subsurface Water Data _____ Page 3

Elevation Bottom of Boring 216.06 M.S.L. Obs. Well _____

Total Depth of Boring 25' Feet Drilled By Briggs Engineering

Core Recovered NA % No. Boxes NA Mfg. Des. Drill Sprague - Henwood

Core Recovered _____ Ft. NX Diam. 2 1/8 in. Inspected By: S. Crowther

Soil Samples 2 1/2 in. Diam. 3 No. Classification By: _____

Soil Samples 2 in. Diam. 4" No. Classification By: _____

DEPTH	CORE/SAMPLE NO.	CORE/SAMPLE SIZE	CORE/SAMPLE DEPTH RANGE	BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
5-12-82 1130 hrs. 0			0.0	6	Drove 2 1/2" ID x 5' Split spoon S from 0.0' to 5.0' - sampled - recovered 23". Hole remained open.	FILL: Gravelly Sand - coarse to fine sand, 10-15% coarse to fine gravel 5-15% nonplastic fines, some cobbles, brown, damp (SP)
2	J1 2 jars	2 1/2"	to	15		
				14		
4	4	2		21		
			5.0	24		
5 1230 hrs.			5.0	50	Drove 2 1/2" x 5" S sampler to 6.5' recovered 6" cased to 7.0' - roller rocked to 7.5' - refusal	Silty Sand - coarse to fine sand, 5-10% coarse to fine gravel, 20-30% nonplastic fines, some cobbles, brown, damp (SM) organics & roots
6	J2 1 of 1	2 1/2"	to 6.5	80/6"	- stiffened	
7.5 300 hrs.					Cored 7.5' to 8.5' w/ NX double-barrel 5" rec. *	Granite boulder
8 8.5			8.5	3	Drove 2" x 5' S. sampler from 8.5' - 13' recovered 20".	Sandy Silt - non plastic silt, 25-35% coarse to fine sand, grey, wet (ML)
	J3 1 of 1	2"	to 13	15		
10						

GENERAL REMARKS: * recored boulder w/ 3" casing bit then recased hole w 3" casing to 13'

① Cored boulder from 7.5 to 8.5
" " " 17.5 to 18.5

Site: Hartland Me.

Boring No. FD-82-3

Page 2 of 3

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
10.5						
12	J4 2 jars			52 105 66/6"	Drove 3" casing to 12' then roller rocked ahead stiffened	Glacial Till: Silty Sand - coarse to Fine sand 20-30% non plastic Fines, coarse to fine gravel some cobbles, wet, grey (SM)
1600 hrs. 14		2"	13 to 17.5	* 66 64	Drove 2" x 5' solid spoon sampler from 12.5' to 17.5 * Blow count from 12.5 - 13.5 : 27. (12.5 - 13' already sampled) 18" Rec.	
5-13-82 16	J5 1 of 1			66		
1730 hrs.				90	Drove 3" casing to 17.5 and washed w/ roller bit refusal @ 17.5'	
17.5			17.5 to 18.5		Cored boulders from 17.5'-18.5' w/ Nx double core barrel. recovered 3.5" (2 min.)	Granite boulders
18.5						
20	J6 3 jars	2"	18.5 to 22.5	45 90 120	Drove 2" x 5' solid spoon sampler from 18.5 to 22.5' Recovered 24"	Glacial Till cont.
22				203	Pulled @ 22.5 to check bottom of spoon for rk.	
22.5					Roller rocked 6" (22.5-23') to checks for rk. - no rk. - sampled	
23						
24	J7 1 of 1	2"	23.0 to 25'	190 151	Drove 2" x 5' solid spoon sampler from 23' to 25' Recovered 13"	Glacial Till, same as above
1040 hrs. 25					Bottom of hole @ 25.0	

3 of 3

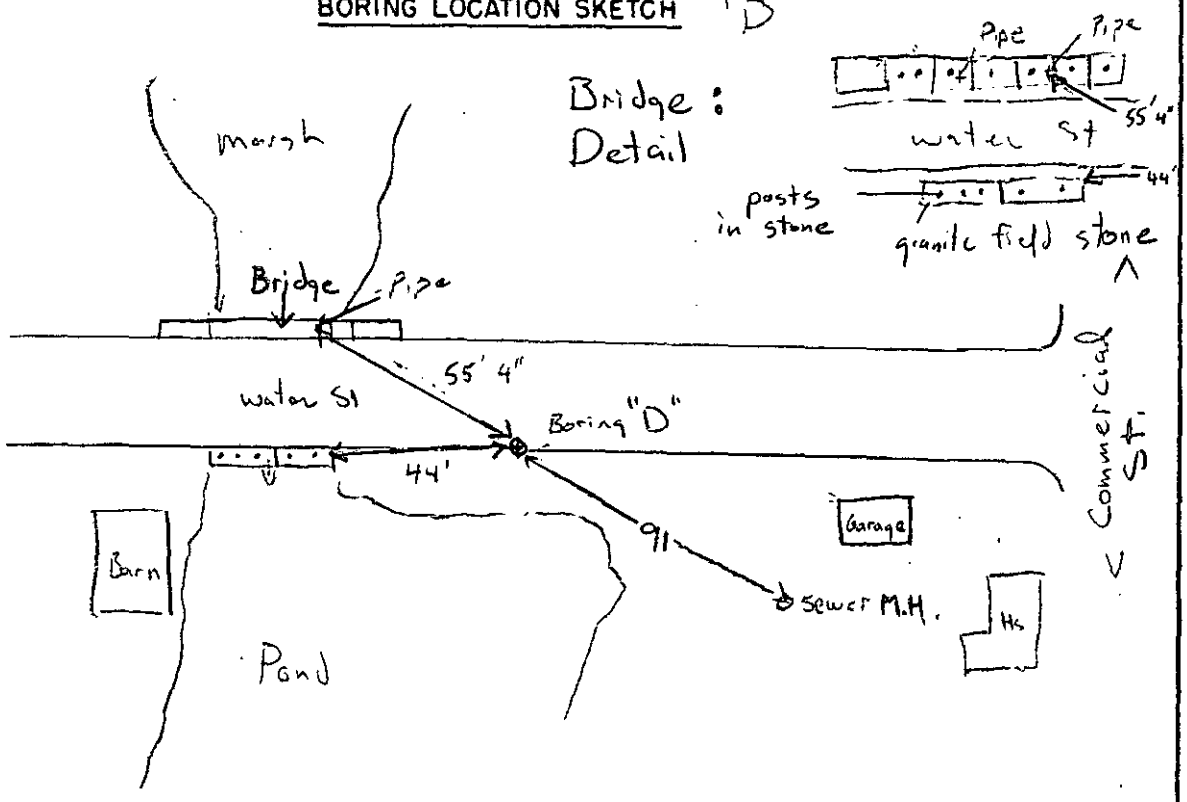
Site: Hartland Me
Boring No: FD-02-3

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
5-13-02	0730	12'	17.5*	6.5'		

Note: Depths are in feet below original ground
* At time of reading

BORING LOCATION SKETCH "D"



FORM 59 (Test)

Boring No. FD-02-3 (D)

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site Hartland Mc. Page 1 of 4 Pages

Boring No. FD-82-4 Desig. E Diam. (Casing) 4"

Co-ordinates: N _____ E _____

Elevation Top of Boring 240.27 M.S.L.
Total Overburden Drilled 11.25' ① Feet
Elevation Top of Rock 229.02 M.S.L.
Total Rock Drilled 10 Feet
Elevation Bottom of Boring 219.02 M.S.L.
Total Depth of Boring 21.25 Feet
Core Recovered 100 % No. Boxes _____
Core Recovered 10 Ft : NX Diam. 2 1/8 In.
Soil Samples 2 1/2 In. Diam. 3 No.
Soil Samples 2 In. Diam. 1 No.

Hammer Wt. 300 lb Boring Started 5-13-82
Hammer Drop 18" Boring Completed 5-13-82
Casing Left 0
Subsurface Water Data _____ Page 3
Obs. Well _____
Drilled By Briggs Engineering
Mfg. Des. Drill Sprague & Henwood
Inspected By: J. Cinotti
Classification By: _____
Classification By: _____

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
5-13-82 1230 hrs 0 .75'	—	2½"	0.0 to 5.0	17	Drove 2½" I.D. x 5' Solid Spoon Sampler From 0.0 to 5.0' recovered 23"	Topsoil - Silty Sand, dark brown - organics.
2	J1 2 jars			17		Gravelly Sand - coarse to fine sand, 10-25% coarse to fine gravel 5-15% non plastic fines some cobbles brown (SW)
				20		
4				4	Water table measured @ 4' 3"	
	2			35		
5.0						
6	J2	NX	5.0 to 7.0		Cored w/ Nx core barrel 5' - 7' 62 min	Boulders + Cobbles
1355 hrs 7.0					After sampling 7.0 - 11.25' recored boulder w/ 3" casing bit + drove casing to 11.25'	
8	J3	2"	7.0 to 11.25	23	Drove 2" x 5' solid spoon sampler from 7' to 11.25' recovered 16"	Gravelly Sand - coarse to fine sand 10-20% coarse to fine gravel 5-10% non plastic fines brown (SW)
				26		
				49		
10	1					

GENERAL REMARKS:
① Cored Boulder from 5' to 7'

Site: Hartland Mc.

Boring No. FD-82-4

Page 2 of 4

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1500 hrs. 11.25'			11.25 ±	58	57/3" w/bounce	
12	RUN I	NX	11.25 to 13'4"	26"	Cored from 11.25' to 13'4" w/ Nx double core barrel and recovered 26" RQD = 16/27 = 59%	Phyllite well developed closely spaced vertical cleavage, closely spaced joints at 40-50° slightly weathered hard, fine grained, numerous calcite veins and seams
13'5"						
14	RUN II	NX	13'4" to 18.5'	61"	Cored from 13'4" to 18.5' w/ Nx double core barrel and recovered 61" RQD = 40/61 = 66%	
16						
18						
18.5						
20	RUN III	NX	18.5 to 21.25	33"	Cored from 18.5' to 21.25' w/ Nx double core barrel and recovered 33" RQD = 33/33 = 100%	
1715 hrs. 21.25'					Bottom of Hole @ 21.25'	

FORM 58A(Test)

Boring No. _____

Site: Hartland Me
Boring No: E

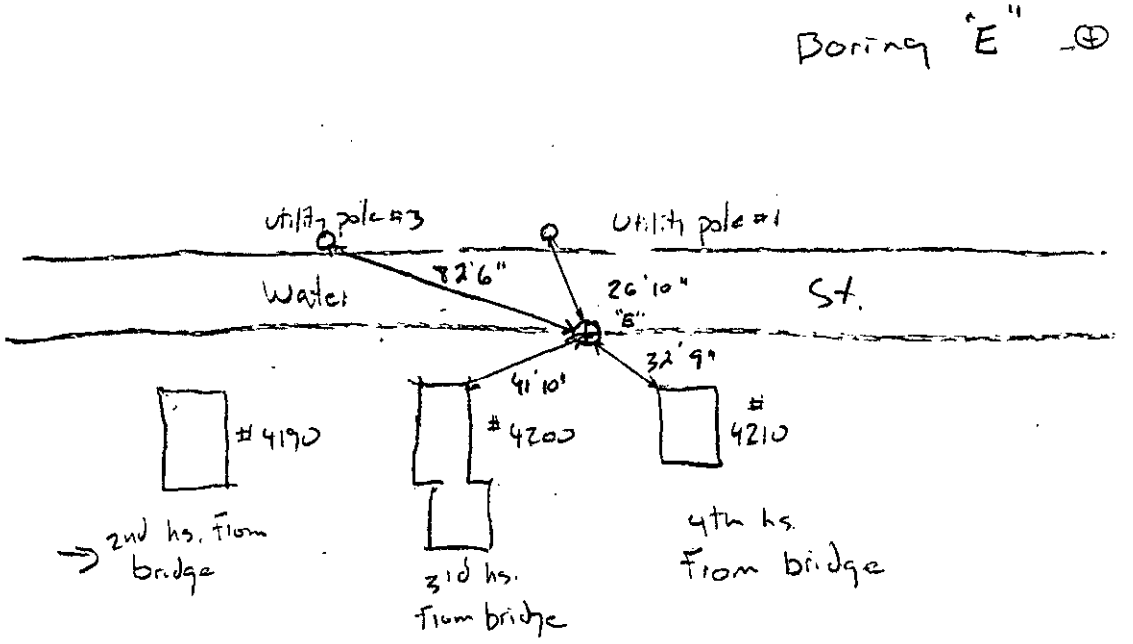
SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
5/13/82	1230	None	5.0'	4' 3"		

650

Note: Depths are in feet below original ground
* At time of water reading

BORING LOCATION SKETCH



FIELD LOG OF TEST BORING IN ROCK

SITE Hartland Me ROLE NO. FD-82-4 PAGE 4 of 4

DATE	DEPTH FT. FROM	DEPTH FT. TO	RUN FT.	RUN REC'V'Y FT.	REC'V'Y %	DRILLING BEHAVIOR FEED	DRILLING BEHAVIOR WATER	DRILLING BEHAVIOR REASON FOR PULL	ACTUAL DRILLING TIME	BIT NO. SIZE AND TYPE	ADDITIONAL REMARKS
5-13-82	11.25	13.4'	26"	26"	100		No loss	core jammed in barrel	29 min	NX	
	13.4	18.5'	61"	61"	100		"	" "	53 min	NX	
	18.5	21.25	33"	33"	100		"	end of hole	31.5 min	NX	

TOTAL BED ROCK DRILLED 10' FEET

TOTAL BED ROCK RECOVERED 10' FEET

BED ROCK RECOVERY 100 PERCENT

DRILLER R. Jones

INSPECTOR J. Crowther

NED FORM DEC 63 130

REPLACES EDITION OF APR 49 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site Hartland Me. Page 1 of 4 Pages

Boring No. FD-82-5 Desig. C Diam. (Casing) 4"

Co-ordinates: N _____ E _____

Elevation Top of Boring 238.75 M.S.L. Hammer Wt. 300 lb. Boring Started 5-14-82

Total Overburden Drilled 8.75 Feet Hammer Drop 18" Boring Completed 5-14-82

Elevation Top of Rock 230.00 M.S.L. Casing Left 0

Total Rock Drilled 15 Feet Subsurface Water Data _____ Page 3

Elevation Bottom of Boring 215.00 M.S.L. Obs. Well _____

Total Depth of Boring 23.75 Feet Drilled By Briggs Engineering

Core Recovered 85 % No. Boxes _____ Mfg. Des. Drill Sprague & Henwood

Core Recovered 12.8 Ft : NX Diam. 2 1/8 In. Inspected By: J. Crowther

Soil Samples 2 1/2" In. Dia m. 4 No. Classification By: _____

Soil Samples _____ In. Diam. ____ No. Classification By: _____

DEPTH	CORE/SAMPLE			BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1"=2'	NO.	SIZE	DEPTH RANGE			
5/14/82 0800			0.0			
			to	14	Drove 2 1/2" x 5' solid spoon sampler from 0.0' to 5.0' recovered 23"	Fill: Silty Sand -
				18		Coarse to fine sand, 20-30% non plastic fines, 15-25% coarse to fine gravel, some cobbles, glass & organics, dark brown (SM)
2	J1	2 1/2"	5	29	Then drove casing to 5.0' & washed	
	1 of 1			19		
4						
4.5				22		
	J2	2 1/2"	5.0 to 6.0	12	Drove 2 1/2" x 5' solid spoon sampler from 5.0' to	Silt - non-plastic silt, some fine sand & organics, grey, damp (ML)
6.0	1 of 1					6.0
6			6.0 to 8.75	64	8.75' and recovered 31" weathered rk. in bottom	Gravelly Sand - coarse to fine sand, 20-30% coarse to fine gravel, 15-25% coarse to fine cobbles, 5-10% non plastic fines, brown, wet (SW)
	J3	2 1/2"		50	Then drove casing to 8.75' & washed out using 3" roller bit	
8	2 jars			65/9"		
8.75 1000 hrs.						
	RUN I	NX	8.75 to 12.1	35"	Cored from 8.75' to 12.1' w/NX double core barrel and recovered 35"	Meta sandstone, very poorly developed vertical cleavage, widely spaced joints at 30-45°, fresh (rust staining along joint planes), very hard, fine grained
10						

GENERAL REMARKS: RQD = 25/35 = 71%

Site: Hartland Me.	Boring No. FD-82-5	Page 2 of 4

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
12	RUN I	NX				
14	RUN II	NX	12.1 to 12.6	46"	Cored from 12.1' to 17.16' w/ NX double core barrel and recovered 46" RQD = 35/61 = 57%	Metasandstone, same as above
16						
18	Run III	NX	17.16 to 22.42	60"	Cored from 17.16' to 22.42' w/ NX double core barrel and recovered 60" RQD 47/63 = 75%	Metasandstone, same as above
20						
22	RUN IV	NX	22.42 to 23.75	12"	Cored from 22.42' to 23.75' w/ NX double core barrel and recovered 12" 14 min RQD: 0	Metasandstone same as above except pitted and iron-stained, seams.
24					Bottom of hole @ 23.75'	

500 hrs.

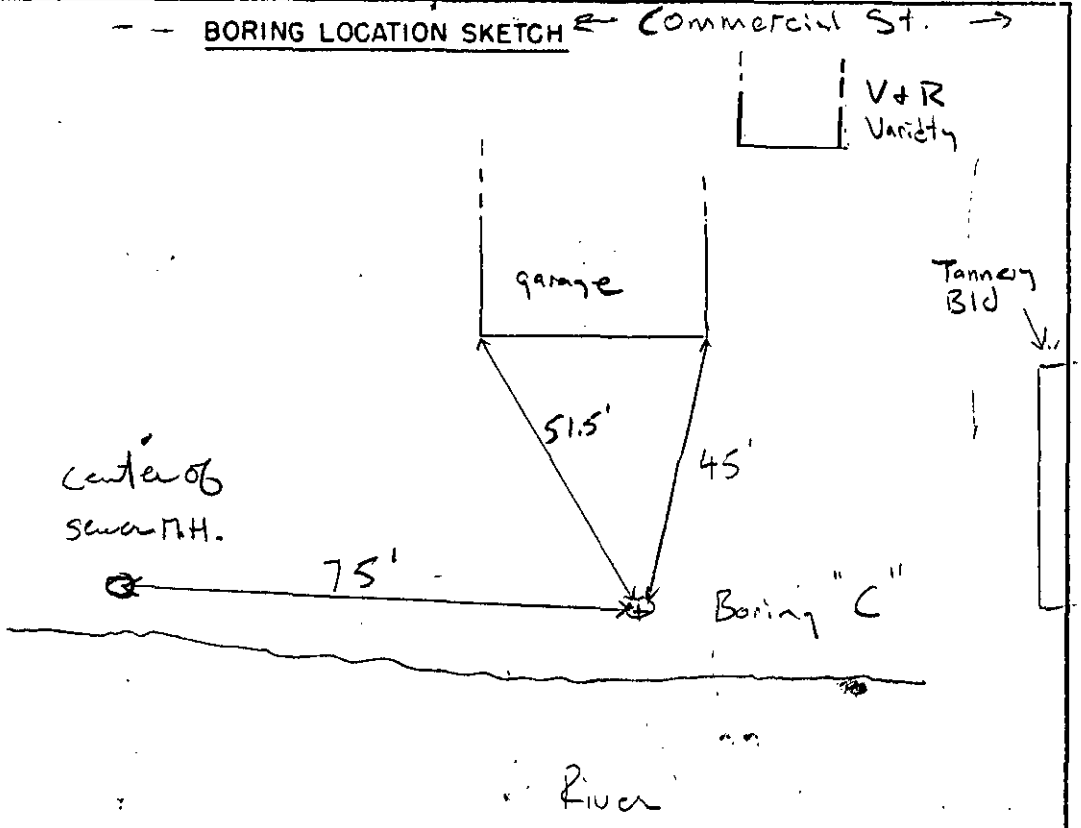
Site: Hartland Me
Boring No: FD-82-5

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
5-14-82	0900	5.0'	10.0' *	4.75'		

Note: Depths are in feet below original ground
* At time of water reading

BORING LOCATION SKETCH



FIELD LOG OF TEST BORING IN ROCK

SITE Hartland Me. ROLE NO. FD-02-5 PAGE 4 of 4

DATE	DEPTH FT. FROM	DEPTH FT. TO	RUN FT.	RUN REC'V'Y FT.	REC'V'Y %	DRILLING BEHAVIOR: FEED	DRILLING BEHAVIOR: WATER	DRILLING BEHAVIOR: REASON FOR PULL	ACTUAL DRILLING TIME	BIT NO. SIZE AND TYPE	ADDITIONAL REMARKS
5-14-82	8.75	12'-1"	40"	35"	87.5		No loss	barrel jammed	44.5 min	NX	
	12'-1"	17'-2"	61"	46"	75		"	"	55 min	NX	
	17'-2"	22'-5"	75"	60"	80		"	"	63.5 min	NX	
	22'-5"	23.75'	16"	12"	75		"	"	14 min	NX	

TOTAL BED ROCK DRILLED 15 FEET

TOTAL BED ROCK RECOVERED 12.8 FEET

BED ROCK RECOVERY 85 PERCENT

DRILLER R. Jones

INSPECTOR J. Crowter

NED FORM DEC 63 130

REPLACES EDITION OF APR 49 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site Hartland Me Page 1 of 4 Pages

Boring No. FD-82-6 Desig. 6 Diam. (Casing) 4"

Co-ordinates: N _____ E _____

Elevation Top of Boring 245.65 M.S.L. Hammer Wt. 300 lb. Boring Started 5-14-82

Total Overburden Drilled 3.75' Feet Hammer Drop 10" Boring Completed 5-14-82

Elevation Top of Rock 241.90 M.S.L. Casing Left 0

Total Rock Drilled 10' Feet Subsurface Water Data _____ Page 3

Elevation Bottom of Boring 231.90 M.S.L. Obs. Well _____

Total Depth of Boring 13.75' Feet Drilled By Briggs Engineering

Core Recovered 100 % No. Boxes 1 Mfg. Des. Drill Sprague + Henwood

Core Recovered 10 Ft : NX Diam. 2 1/8 In. Inspected By: J. Crowther

Soil Samples _____ In. Dia m. ___ No. Classification By: _____

Soil Samples _____ In. Diam. ___ No. Classification By: _____

DEPTH		CORE/SAMPLE			BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	1"=2	NO.	SIZE	DEPTH RANGE			
5-14-82 0700 hrs				0.0 to 2.75	7 / 7 / 66/9" w/bounce	Drove 2 1/2" x 5' solid spoon sampler from 0.0' to 2.75' recovered 16"	Silty Sand – coarse to fine sand, 20-30% non plastic fines, some med. to fine gravel, cobbles, organics, dark brown wet (SM)
2.75	2	J1 to F1	2 1/2"	2.75			
805 hrs. 3.75	4			2.75 to 3.75		Cored from 2.75 to 3.75' w/ 3" casing bit to establish room for core barrel.	Phyllite – poorly developed closely spaced nearly vertical cleavage, slightly weathered, hr ', fine grained, w/ calcite veins and minor pyrite crystals
	6	RUN I	NX	3.75 to 8.75	60"	Cored from 3.75' to 8.75' w/ NX double core barrel and recovered 60" RQD = 39/60 = 65%	
8.75	8	RUN II	NX	8.75 to	31"	Cored from 8.75' to 11'+33" w/ NX double core barrel and recovered 31"	Phyllite – same as above

GENERAL REMARKS:

Site: Hartland Mc	Boring No. FD-82-6	Page 2 of 4

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATER ALS
11'-4"			11.33		RQD $\frac{29}{31}$: 94%	
12	RUN III	NX	11.33 to 13.75	29"	Cored from 11'-4" to 13.75' w/ NX double core barrel and recovered 29" RQD $\frac{21}{29}$: 72%	Pyllite same as above 1 seam
1045 14					Bottom of hole @ 13.75'	

Site: Hartland Me
Boring No: FD-82-6

SUBSURFACE WATER OBSERVATIONS

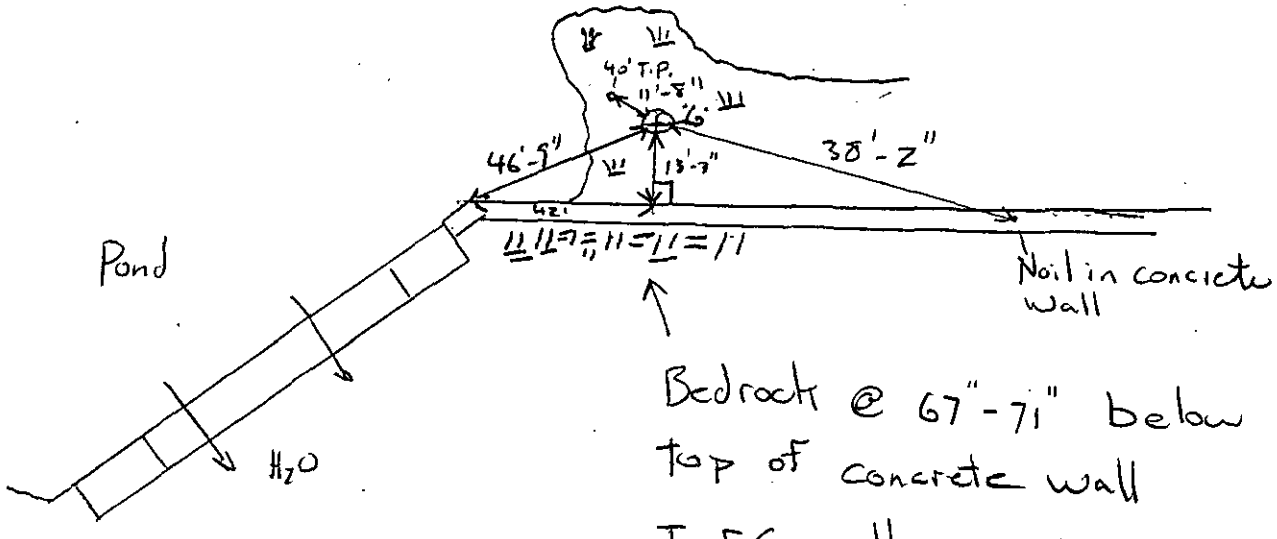
DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
5-15-82	1125 hrs.	None	13.75'	12"		

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

(• 40' Turning Point)

Boring "6"



Bedrock @ 67"-71" below top of concrete wall

T. of C. wall 249.4' ±

FIELD LOG OF TEST BORING IN ROCK

SITE Hartland Me. ROLE NO. FD-82-6 PAGE 4 of 4

DATE	DEPTH PT. FROM	DEPTH PT. TO	RUN PT.	RUN REC'V'Y PT.	REC'V'Y %	DRILLING BEHAVIOR: FEED	DRILLING BEHAVIOR: WATER	DRILLING BEHAVIOR: REASON FOR PULL	ACTUAL DRILLING TIME	BIT NO. SIZE AND TYPE	ADDITIONAL REMARKS
5-14-82	3.75	8.75	60"	60"	100		No loss	barrel jammed	56.5 min	NX	
	8.75	11.33	31"	31"	100		"	"	33.5	NX	
	11.33'	13.75'	29"	29"	100		"	"	29	NX	

TOTAL BED ROCK DRILLED 10 FEET

TOTAL BED ROCK RECOVERED 10 FEET

BED ROCK RECOVERY 100 PERCENT

DRILLER R. Jones

INSPECTOR J. Crowther

NED FORM DEC 63 130

REPLACES EDITION OF APR 49 WHICH MAY BE USED UNTIL EXHAUSTED

APPENDIX B

Survey Field Notes

5/14/82

	245.31			
		4.25		
			241.06 ✓	
		✓ 4.35		
4.35	245.31		240.96 ✓	
		5.04		
			240.27 ✓	
		✓ 1.10		
7.48	251.69		244.21 ✓	
		2.29		
			249.40 ✓	NOTE LEVELS ADJUSTED TO THIS ELEV
		5.33		
11.50	257.86 ✓		246.36 ✓	
		12.50		
			245.36 ✓	
		11.50		
2.14	248.5 ✓		246.36 ✓	
		4.29		
1.17	245.38		244.21 ✓	
		5.11		
5.58	245.85 ✓		240.27 ✓	
		4.59		
.87	242.13 ✓		241.26 ✓	
		3.36		
13.13	251.88 ✓		238.75 ✓	
		.06		
3.96	255.78 ✓		251.82 ✓	
		6.79		
			248.99 ✓	
			(248.98)	

BORING PT "D"

TP ROCK

BORING PT "E"

SPLD OF HYD @ END OF WATER ST RT ℄

TOP OF CONC DAM HELD ELEV 249.40

TOP OF [illegible] PIPE 249.40 / 4.25 / 244.65 [illegible] ELEV BORING PT "G" 245.65

ELEV OF WATER @ DIKE [illegible] W.H. [illegible]

TOP CONC PIPE

TOP HYD SPLD @ MILL ST & WATER RT ℄

TP PT #1

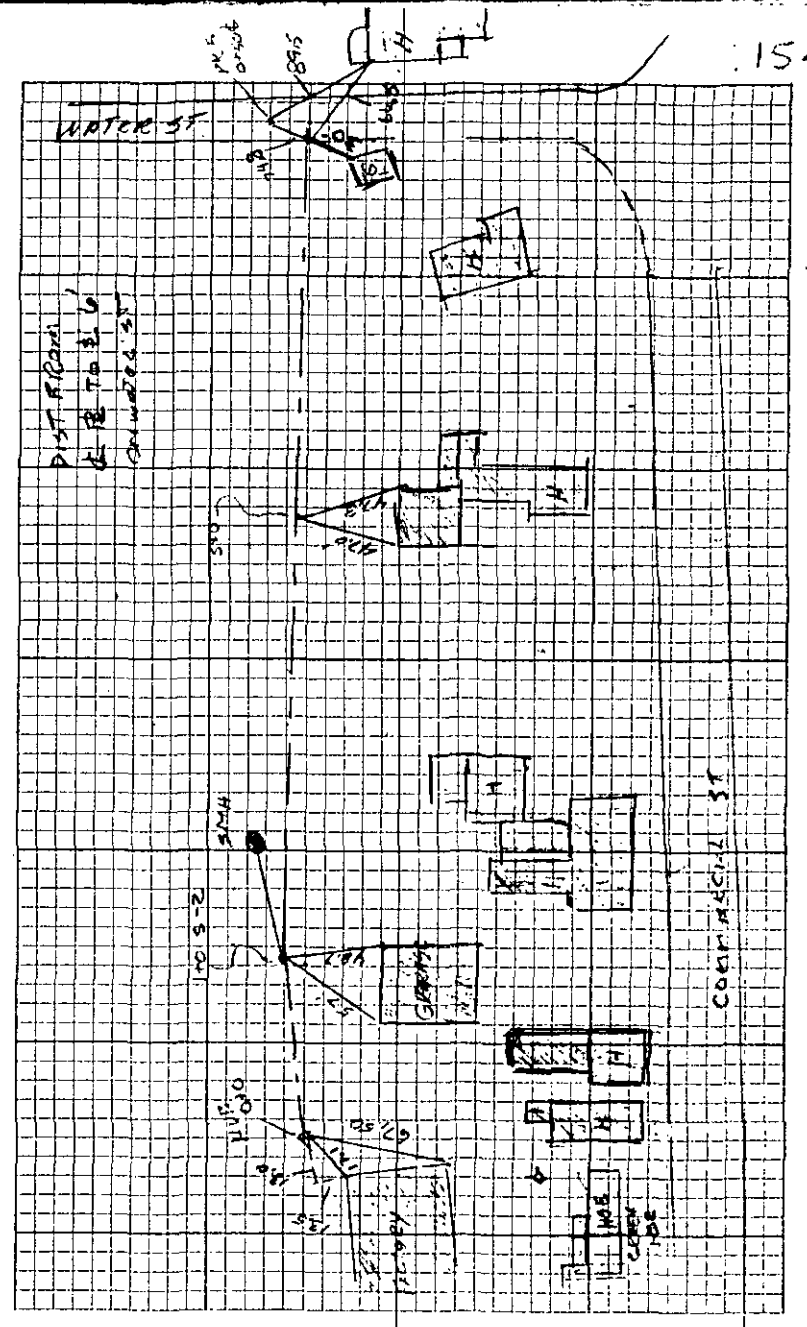
PK PT #1

RIM SMH

HYD [illegible] MILL ST [illegible] ST

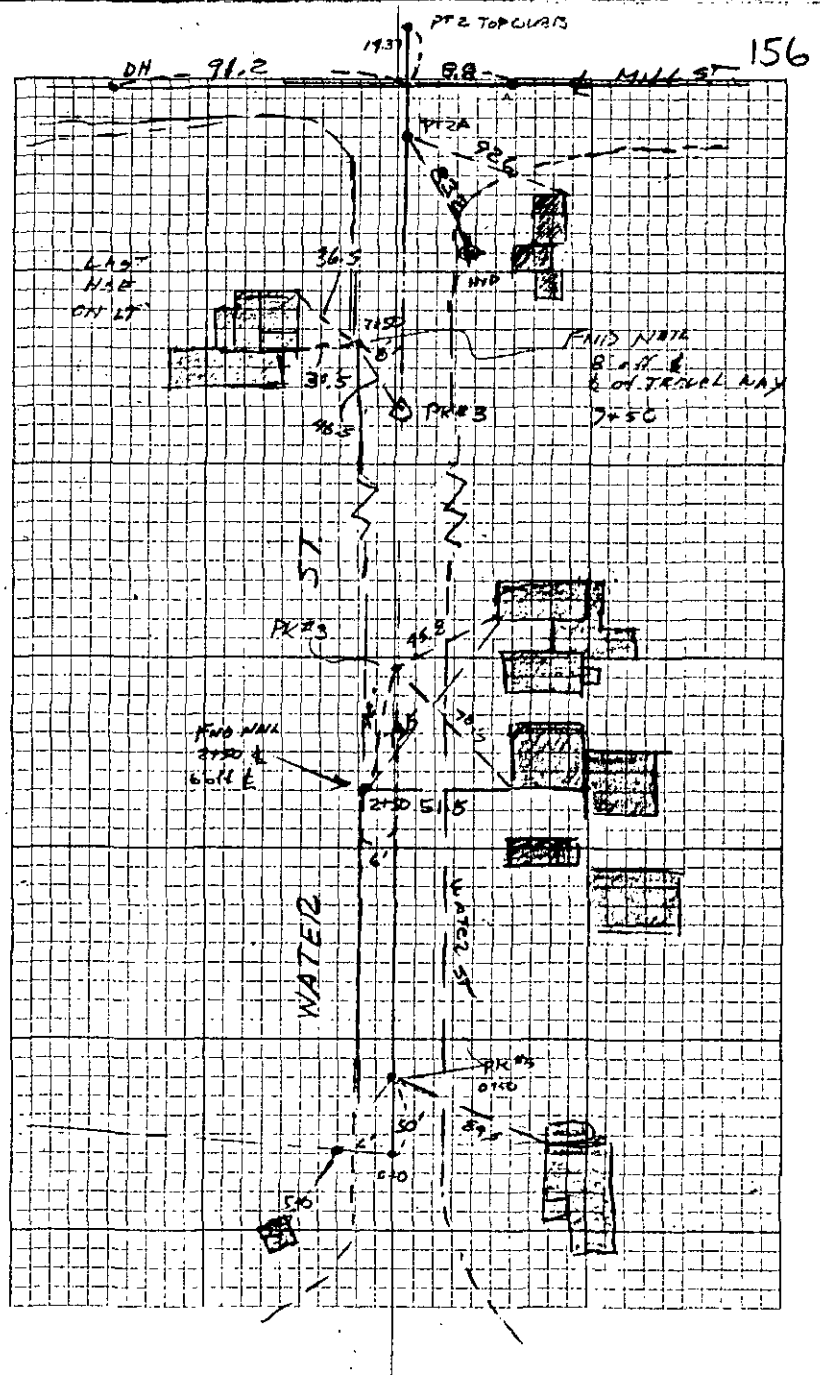
TOP [illegible]

			5+14.80
	.03	251.85	251.82 HUB
0+0	8.09		OC
0+10	8.41		TOP SLOPE
0+18	9.65		TOE SLOPE
0+40	9.70		TOP SLOPE
0+60	12.52		OC
1+0	13.15		OC
1+50	14.33		
1+80	13.26		
2+0	13.33		
2+50	14.11		
3+0	14.63		
	4.59	246.85	241.26 PK SQ. NAIL WATER ST
3+50	8.75		
4+0	9.30		
4+50	9.60		
5+0	6.62		
5+10	5.08		℄ ROAD

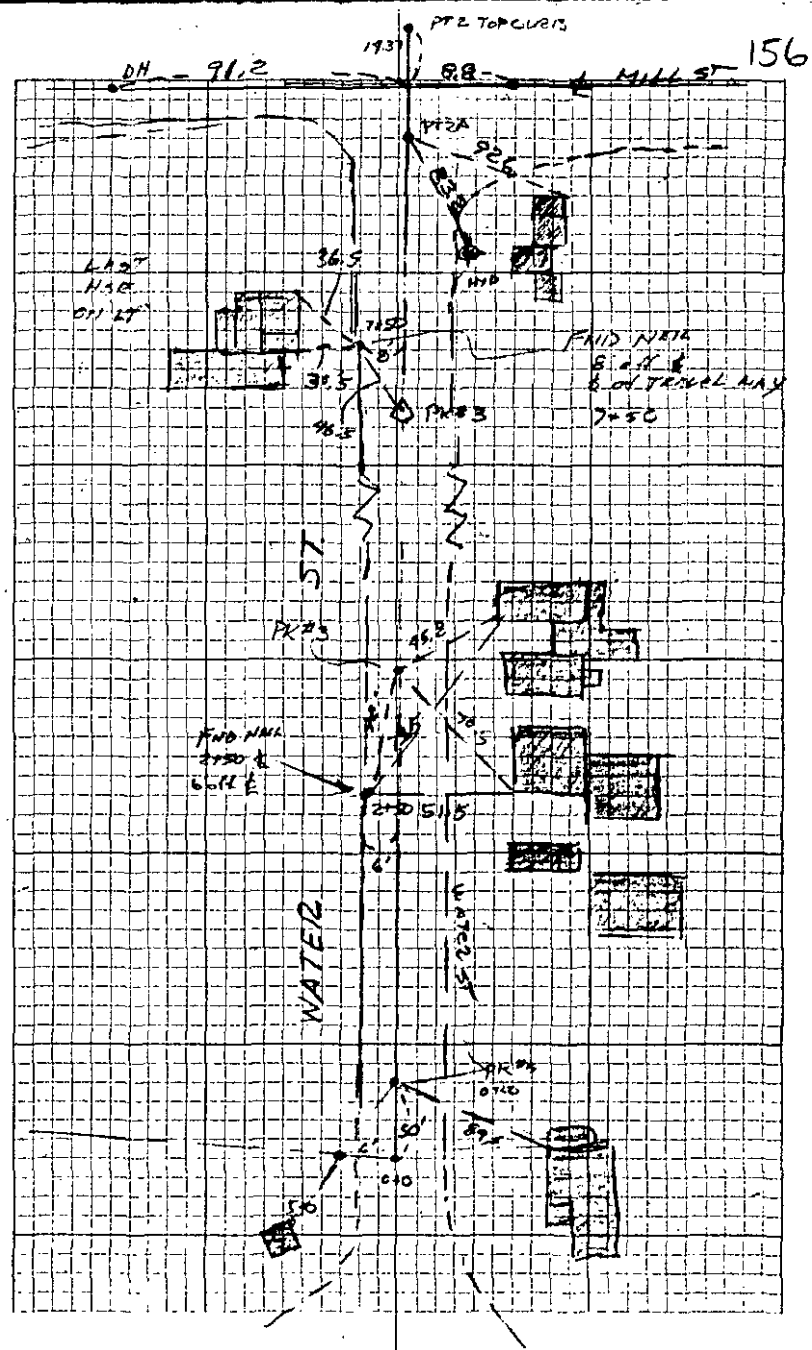


5/15/82

	4.40 245.66		241.26	TOPPY #2
PK & PCAB 0+0	4.67			
0+50 PK#5	4.40			
1+0	4.04			
1+50	4.13			
2+0	4.62			
2+50	6.09			
3+0	5.40			
	4.97 245.21		240.27	TOPPY #1
3+50	4.78			
4+0	4.32			
4+50	4.31			
5+0	4.52			
5+50	4.72			
6+0	4.73			
6+50	4.66			
7+0	4.66			
+ 7+50	4.44			
8+0	4.75			
8+50	4.50			
9+0	3.95			
9+50	1.89			
10+0	1.50			
	5.80 250.01		244.21	HYD
10+27	5.52	PK CAP	12+08 9.80	Bot Slope
10+28	4.96	Top Curb	12+20 7.71	
10+33	4.84	Back SW	12+68 8.20	Top Slope
10+37	5.20	Top Curb	13+0 3.80	Bot Dam
10+50	10.80	Bot Brick	13+0 .65	Top Dam
11+10	9.40	OS		
11+68	9.06	OS		
12+0	10.28			



			5/15/92	
	4.40 245.66		241.26	TOPPY #5
PK & PCAL 0+0	4.67			
0+50 PK#5	4.40			
1+0	4.07			
1+50	4.13			
2+0	4.62			
2+50	6.09			
3+0	5.10			
	4.97 246.24		240.27	TOPPY #1
3+50	4.75			
4+0	4.32			
4+50	4.31			
5+0	4.52			
5+50	4.72			
6+0	4.73			
6+50	4.66			
7+0	4.86			
7+50	4.95			
8+0	4.75			
8+50	4.50			
9+0	3.95			
9+50	1.89			
10+0	1.50			
	5.80 250.01		241.21	HYD
10+27	5.90	ASPHALT	12+08	9.80 TOP SLOPE
10+28	4.56	TOP CURB	12+20	7.71
10+33	4.84	BACK SW	12+68	3.20 TOP SLOPE
10+37	5.20	TOP BANK	13+0	3.80 BOT DAM
10+50	10.80	BOT BANK	13+0	.65 TOP DAM
11+0	9.40	OS		
11+62	9.06	OS		
12+0	10.28			



APPENDIX C

Weston Geophysical's Report

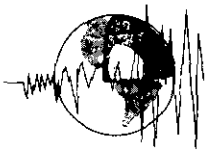
GEOPHYSICAL INVESTIGATIONS

HARTLAND, MAINE

Prepared for

BRIGGS ENGINEERING & TESTING CO.

July 1982



Weston Geophysical
CORPORATION

Weston Geophysical
CORPORATION

July 2, 1982
WGC-419-3

Briggs Engineering & Testing Co.
164 Washington Street
Norwell, Massachusetts 02061

Gentlemen:

In accordance with your letter of authorization dated May 3, 1982, we are pleased to submit our findings of the seismic survey conducted at Hartland, Maine.

This is a formal presentation of our findings.

Very truly yours,

WESTON GEOPHYSICAL CORPORATION

Edward Rostosky

Edward Rostosky
for Vincent J. Murphy

ER:VJM:eag

Enclosure

Post Office Box 550 • Westboro, Massachusetts 01581 • (617) 366-9191

GEOPHYSICAL INVESTIGATIONS

HARTLAND, MAINE

Prepared for

BRIGGS ENGINEERING & TESTING CO.

July 1982

Weston Geophysical
CORPORATION

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LIST OF FIGURES

INTRODUCTION AND PURPOSE

In accordance with your letter of authorization dated May 3, 1982 a seismic survey was conducted in Hartland, Maine. This study was conducted on May 4 and 5, 1982. The purpose of this investigation was to determine the rock surface for a proposed pipeline near the Sebasticook River in Hartland, Maine.

All fieldwork was coordinated through Mr. Nicholas Lanney of Briggs Engineering & Testing Co.

LOCATION AND SURVEY CONTROL

The seismic refraction survey was performed near the Sebasticook River in Hartland, Maine. The site area is shown on the enclosed segment (Figure 1) of the Pittsfield, Maine United States Geological Survey Quadrangle Map. The specific lines of coverage are shown on a plan (Figure 2) provided by Briggs Engineering. A total of 1880 linear feet of refraction profiling was accomplished. Survey control was also provided by Briggs Engineering.

METHOD OF INVESTIGATION

The field program consisted of continuous land refraction profiling utilizing geometrics model ES1210 multi-channel signal enhancement seismograph. A 150 pound weight was used with drop points every 100 feet. Geophones were positioned at 10- and 20-foot intervals and spread lengths were 200 feet. A discussion of the seismic refraction profiling technique is included as Appendix A to this report.

PRESENTATION OF RESULTS

Results of this seismic survey are presented on the enclosed seismic profile sheet, Figure 3. Seismic velocity

values for the various strata and the elevations of the velocity interfaces are indicated. The elevations of the velocity interfaces are referenced to ground surface elevations provided by Briggs Engineering.

A discussion of general material identification based on seismic velocities is included as Appendix B to this report.

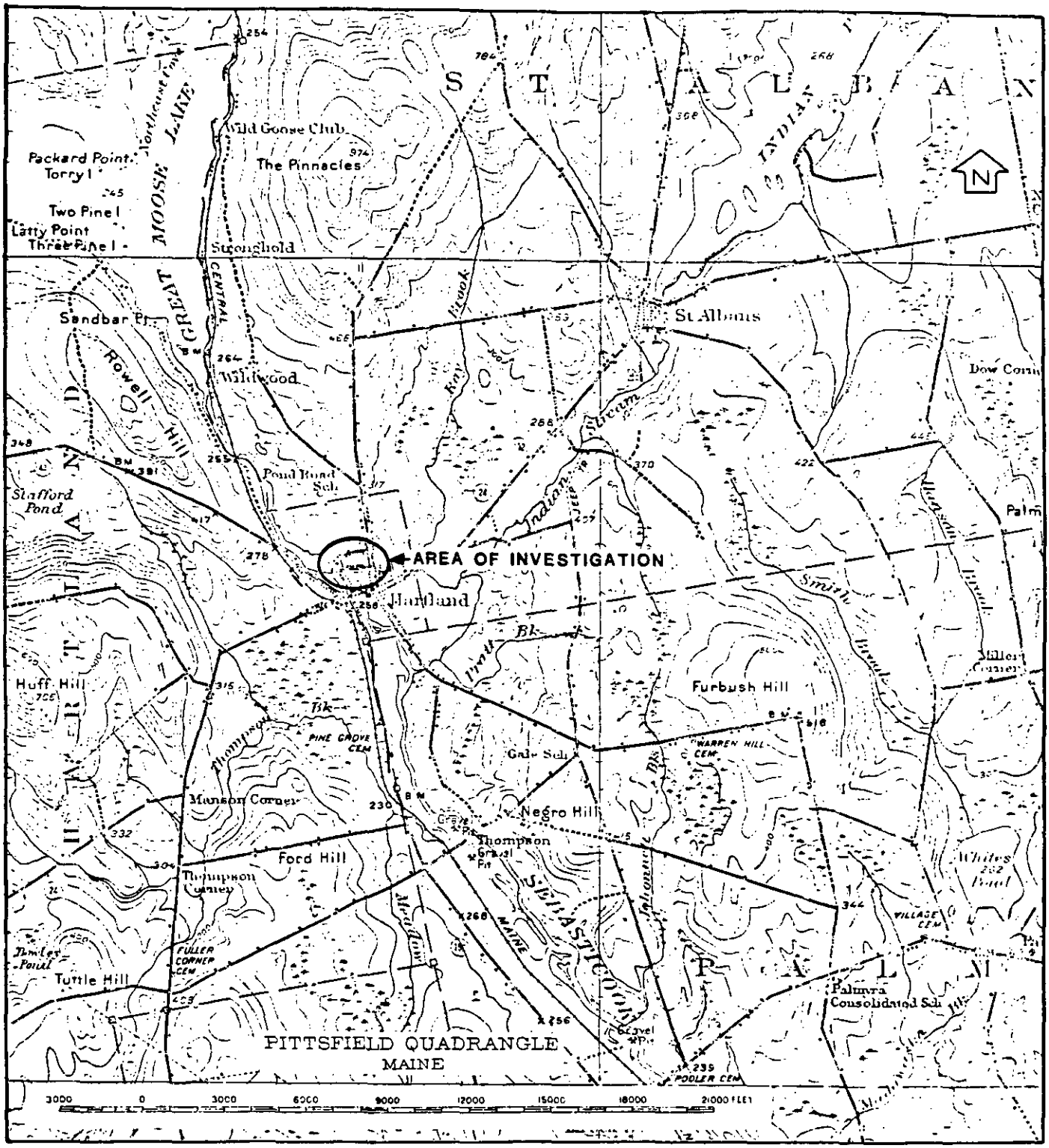
DISCUSSION OF RESULTS

The seismic refraction profiles indicate that bedrock is generally 15 to 20 feet deep along Line S-1. In the vicinity of stations 5+50 to 8+50 bedrock is approximaterly 8 feet below ground surface. The seismic data between Stations 10+50 and 12+50 was re-evaluated in lite of borings conducted by the state of Maine. Boring AC25-77 indicates bedrock at Elevation 235 which is in the vicinity of Station 10+50, Line S-1. A cross line conducted at Station 11+50, which was high quality data, indicates the bedrock at Elevation 215. Due to the steep sloping rock surface the boring drilled near the bridge abutment was used for depth control.

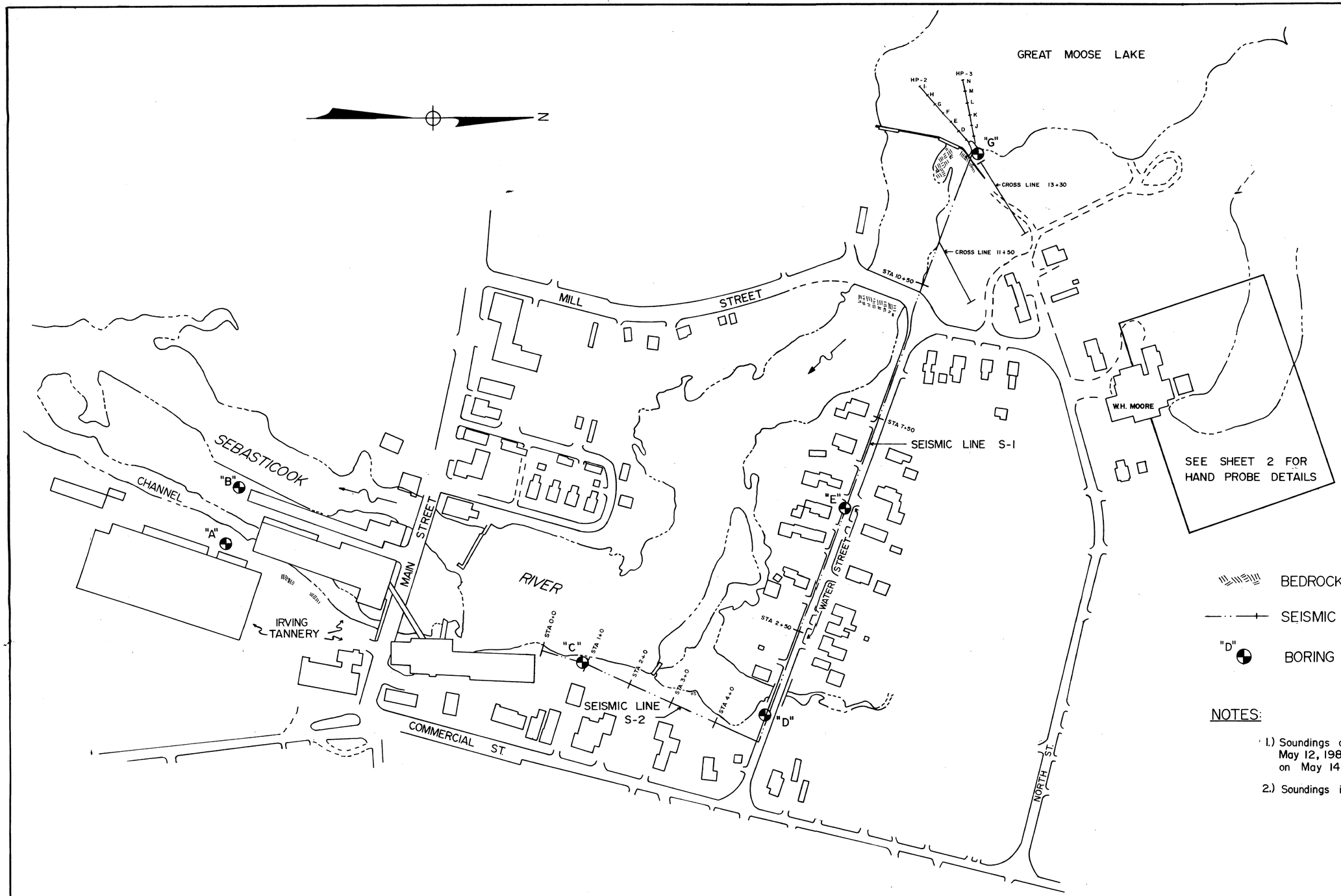
It should be noted that the area of this survey is a locale where the depth to rock appears to vary considerably in short distances. For example the northerly end of seismic Line S-2 and the easterly end of Line S-1 demonstrate this variation in the rock surface.

Adverse ground surface conditions precluded data collection between Stations 12+50 and 13+30 of Line S-1. A cross line operated at station 13+30 of the center-line indicates bedrock at 5 to 10 feet below ground surface. Although the quality of the seismic data for Line S-2 was adversely affected by debris and fill material, an area of shallow bedrock (2 to 3 feet) is detected in the vicinity of station 4+0. The groundwater table is generally shallow for all areas investigated.

FIGURES



SEISMIC SURVEY HARTLAND, MAINE for BRIGGS ENGINEERING	AREA OF INVESTIGATION
	WESTON GEOPHYSICAL CORPORATION JULY 1982 FIGURE 1



SOUNDING LOCATIONS	WATER DEPTH
D	5'
E	7'
F	9'
G	9'
H	8.5'
I	8'
J	4'
K	6'
L	13'
M	7.5'
N	7'

BEDROCK OUTCROPS

SEISMIC LINE WITH STATIONS

"D" BORING LOCATION & DESIGNATION

NOTES:

1.) Soundings on Great Moose Lake taken on May 12, 1982. Water level at elevation 244.65 on May 14, 1982.

2.) Soundings indicate a rocky lake bottom.

BRIGGS ENGINEERING & TESTING CO.
164 WASHINGTON ST. NORWELL, MA.

PROJ. NO. 13101

TITLE: EXPLORATION LOCATION PLAN

SCALE: 1" = 100' | DATE: 5-21-82

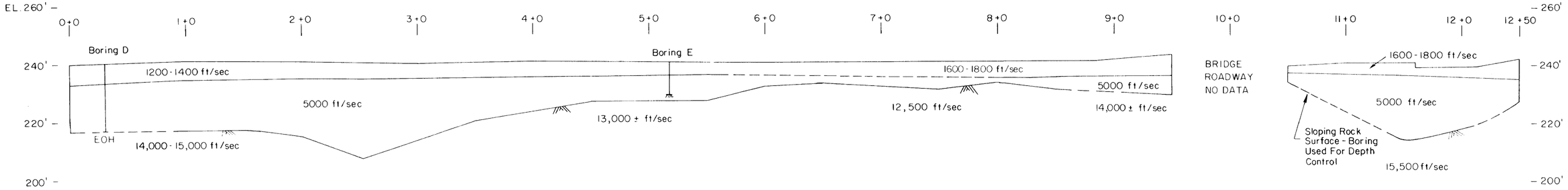
DRAWN: J.C.C. | CHECKED: N.A.L.

SHEET 1 of 2

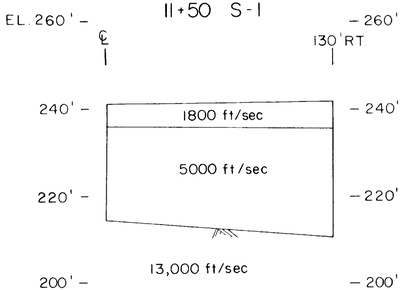
WESTON GEOPHYSICAL CORP.

FIGURE 2

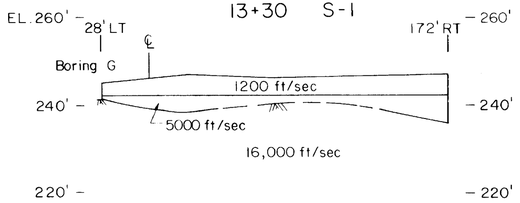
LINE S-1



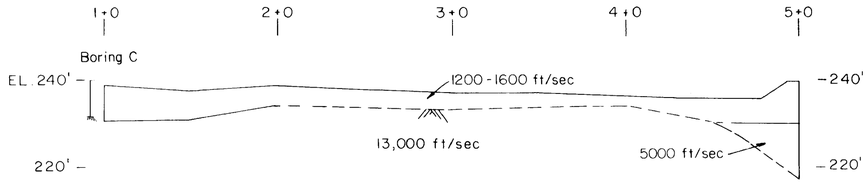
CROSSLINE 11+50 S-1



CROSSLINE 13+30 S-1



LINE S-2



SEISMIC SURVEY HARTLAND, MAINE for BRIGGS ENGINEERING & TESTING CO.	SEISMIC PROFILES WESTON GEOPHYSICAL CORPORATION JULY 1982 FIGURE 3

APPENDIX A

SEISMIC REFRACTION SURVEY
METHOD OF INVESTIGATION

APPENDIX A

SEISMIC REFRACTION SURVEY
METHOD OF INVESTIGATION

General Considerations

The seismic refraction survey method is a means of determining the depths to a refracting horizon and the thickness of major seismic discontinuities overlying the high-velocity refracting horizon. The seismic velocities measured by this technique are used for generalized material identification and stratigraphic correlation.

Interpretations are based on the measurement of the time required for elastic waves, generated at a point source, to travel to a series of vibration sensitive devices (geophones) spaced at known intervals on the ground surface (Diagram A).

Field Procedure for Data Acquisition

The seismic refraction equipment consists of an EG&G Geometrics Model ES-1210 multichannel signal enhancement sesimograph.

Continuous profiling is accomplished by having the end shot point of one spread coincident with the end or intermediate position shot point of the succeeding spread. The spread length used in a refraction survey is determined by the required depth of penetration to the refracting horizon. It is generally possible to obtain adequate penetration when the depth to the refracting horizon is approximately one quarter of

the spread length. The spread length used in this study was 200 feet with the corresponding geophone intervals indicated on Diagram B.

Shots are usually located at each end and at the center of the seismic spread (Diagram B). The configuration of the geophone array and the shot point positions are dependent upon the objectives of the seismic investigation.

Seismic energy is generated by a 150 pound weight drop against a plate from a height of 7 feet. The plate is embedded into the ground to insure good ground coupling.

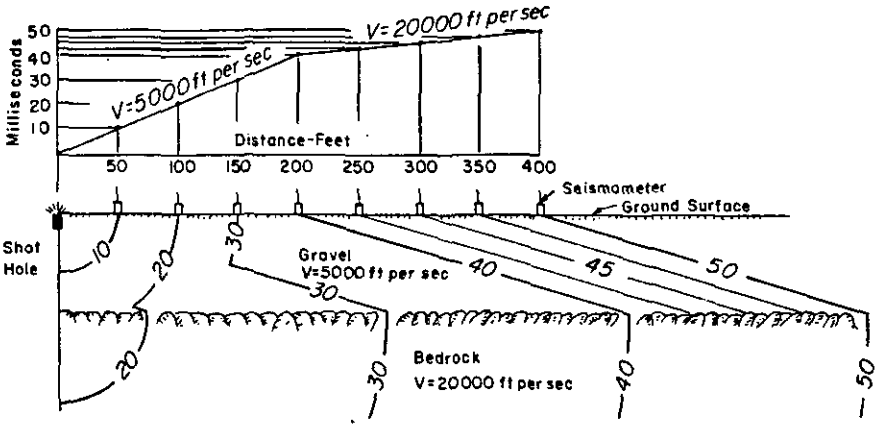
The geophone is in direct contact with the earth and converts the earth motion resulting from the weight drop energy into electric signals. Weston uses an electromagnetic geophone for seismic refraction profiling. This type of detector consists of a magnet permanently attached to a spiked base which can be rigidly fixed to the earth's surface. Suspended within the magnet is a coil wrapped mass. Relative motion between the two produces an electric current, with a voltage proportional to the velocity of the motion.

The electric current flows from the geophones through a series of cables to the recording device generating a seismogram. The portable 12-trace seismograph system produces simultaneous monitoring of each of the 12 geophones. The operator can amplify and filter the seismic signals to minimized background interference. The system provides an

electrostatic record of the 12 traces of each shot. A recording is obtained for each of the shot locations indicated on Diagram B, Page A4. Timing lines are indicated on the records at two millisecond intervals providing reading accuracy to one millisecond. This system contains a firing circuit which initiates data recording when the plate is struck by the 150 pound weight. The arrival times between the shot and each geophone are measured in reference to this time break. This seismograph unit has a stacking capability which permits systematic addition of signals with repeated weight drops at the same location.

Interpretation Theory

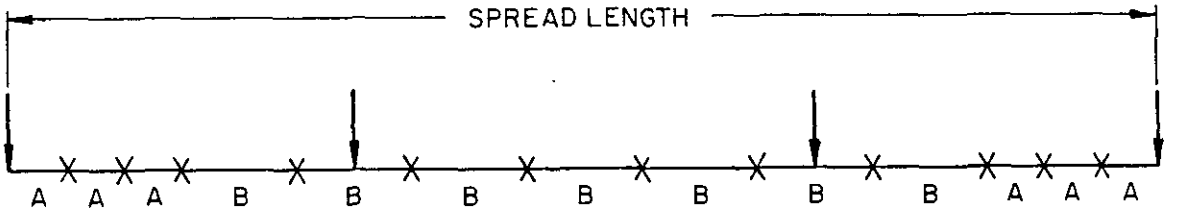
The elastic wave measured in the seismic refraction method, the "P" or compressional wave, is the first arrival of energy from the source at the detector. This energy wave travels from the energy source in a path causing adjacent solid particles to oscillate in the direction of wave propagation. Diagram A shows a hypothetical subsurface consisting of a lower velocity material above a higher velocity material. At smaller distances between source and detector the first arrival waves will be direct waves that travel near the ground surface through the lower velocity material. At greater distance, the first arrival at the detector will be a refracted wave that has taken an indirect path through the two velocity layers. The refracted wave will arrive before the direct wave at a greater



Plot of Wave Front Advance in Two Layered Problem

Linehan, Daniel, Seismology Applied to Shallow Zone Research, Symposium on Surface and Subsurface Reconnaissance, Special Technical Publication No. 122, American Society for Testing Materials, 1951.

Diagram A



SPREAD LENGTH	GEOPHONE SPACING	A	B
200		10	20

LEGEND

X = GEOPHONE LOCATION

↓ = SHOT LOCATION

Geophone Interval-Spread Length Relationship

Diagram B

distance along the spread because the time gained in travel through the higher-speed material compensates for the longer path. Depth computations are based on the ratio of the layer velocities and the horizontal distance from the energy source to the point at which the refracted wave overtakes the direct wave.

APPENDIX B

GENERAL MATERIAL IDENTIFICATION BASED ON SEISMIC VELOCITIES

APPENDIX B

GENERAL MATERIAL IDENTIFICATION
BASED ON SEISMIC VELOCITIES

Material Identification

Using seismic data alone, materials can be placed into broad classifications based on the velocity of the seismic wave transmitted through them. Most bedrock as well as overburden types fall within the restricted velocity ranges given below, however, velocity values do not have unique material correlations.

Overburden

The velocity range of a few hundred to less than 1,000 ft/sec. (fps) is indicative of very loose and unsaturated silts, humus, and loose fill materials.

The velocity range of 1,000 to 2,500 fps is indicative of unconsolidated, and unsaturated materials; commonly measured in glacial fluvial deposits.

The velocity range of 2,400 to 3,000 fps is indicative of an unsaturated material, possibly a ground moraine-type of glacial till. The range of 3,000 to 4,500 fps is usually indicative of a more compact and unsaturated type of glacial till; it is commonly measured in colluvial deposits and partially saturated varved silts.

Seismic velocity values of 4,800 to 5,300 fps are indicative of water-saturated fluvial deposits. This velocity

range is characteristic of materials which have been developed successfully as municipal groundwater supplies. Varved clay has a characteristic velocity of 5,000 fps whether above or below the water table.

The velocity range of 5,400 to 6,000 fps is characteristic of a saturated till.

The range of 6,500 to 8,500 fps is characteristic of very dense glacial till; drumlin tills are in this velocity range.

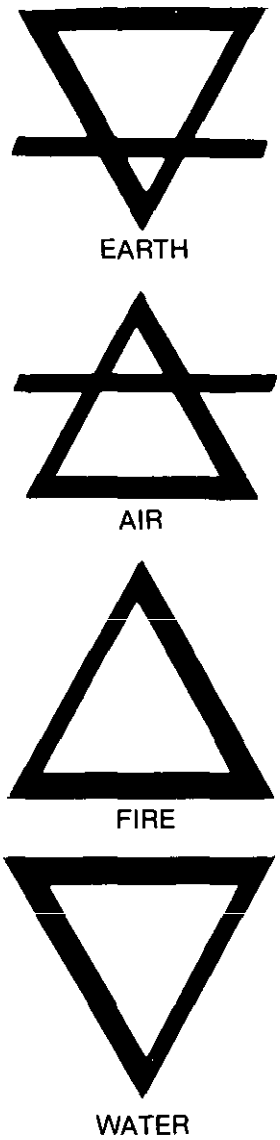
Bedrock

Depending upon the degree of weathering, bedrock can have seismic velocity values spanning virtually the entire range of values for overburden; at the lower end of this range, however, the bedrock will have the physical characteristics of overburden.

Seismic velocities in the range of 8,000 to 10,000 fps are commonly indicative of slightly to moderately weathered bedrock which may require at least localized drilling and blasting for excavation.

Velocities above 10,000 fps are indicative of bedrock which is generally sound and unweathered, and which will require systematic drilling and blasting for excavation.

In ancient times
Greek and Hindu philosophers
believed that there were
four elements in the material universe
— EARTH, AIR, FIRE and WATER.
Over the years
man's knowledge has expanded
and the world of materials
is now known to be extremely complex.
The unravelling of these complexities
is the continuing goal of
Briggs Engineering & Testing Company.



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Engineering and Testing

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